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ABSTRACT

One of a series of pre-apprenticeship phase 1 training modules dealing with math skills, this self-paced student module covers compound numbers. Included in the module are the following: cover sheet listing module title, goals, and performance indicators; introduction; study guide/check list with directions for module completion; information sheet; self-assessment; self-assessment answers; and post assessment. Emphasis of the module is on the addition, subtraction, multiplication, and division of such compound numbers as those occurring in the common units of measurement typically encountered by workers in the skilled trades. (Other related pre-apprenticeship phase 1 training modules are available separately--see note.) (MN)

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ED217287

INDIVIDUALIZED LEARNING SYSTEMS

PRE-APPRENTICESHIP PHASE 1 TRAINING

MATH

COMPOUND NUMBERS

CE032423

Goal:

The student will know the necessary math concepts in compound numbers to enable him or her to compute math problems in which these concepts are used.

Performance Indicators:

Given a series of math problems in the Self Assessment and Post Assessment portions of this module, the student will be able to successfully compute the answers.

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Introduction

Workers in the skilled trades frequently must solve problems involving the addition, subtraction, multiplication, and division of compound numbers, which are expressions containing two or more unlike but related units of measure, such as 6 ft. 2 in. or 4 lb. 3 oz. Each of the two or more parts of a compound number is called a denominate number. In the examples given above, 6 ft., 2 in., 4 lb., and 3 oz. are all denominate numbers.

Study Guide

This study guide is designed to help you successfully complete this module. Check off the following steps to completion as you finish them.

STEPS TO COMPLETION

1. ____ Familiarize yourself with the Goal and Performance Indicators on the title page of this module.

2. ____ Read the Introduction and study the Information section of the module. It is intended to provide you with the math skills necessary to successfully complete the assessment portions.

3. ____ Complete the Self Assessment section of the module. You may refer to the Information section for help.

4. ____ Compare your Self Assessment answers with the correct answers on the Self Assessment Answer Sheet immediately following the Self Assessment exam. If you missed more than one of the Self Assessment exam questions, go back and re-study the necessary portions of the Information section, or ask you instructor for help. If you missed one or none of these problems, go on to step 5.

5. ____ Complete the Post Assessment section of the module. Show your answers to the instructor. It is recommended that you score 90% or better on those Post Assessment exams with 10 or more problems, or miss no more than one problem on those with fewer than 10 problems, before being allowed to go on to the next math module.

Information

REDUCTION OF COMPOUND NUMBERS

The principles of adding, subtracting, multiplying, and dividing compound numbers are outlined in the illustrative problems presented in this topic. Each problem is accompanied by its step-by-step solution. The units of measure chosen for the problems are feet and inches, but the principles demonstrated apply equally to compound numbers involving pounds and ounces, hours and minutes, and the like. Except in the case of the simplest addition and subtraction problems, the reduction (changing) of related but unlike units is an essential setp in working with compound numbers. This is so because only like units can be combined in an arithmetical operation. After this reduction has been accomplished, operations involving compound numbers can be performed in the conventional way.

Reduction from higher to lower denomination units

Problem: Reduce 13 feet to inches

Step 1. 1' = 12"
Step 2. 13 x 12 = 156"

Reduction from lower to higher denomination units

Problem: Reduce 216 inches to feet

Step 1. 12" = 1'
Step 2. 216" ÷ 12 = 18'

ADDITION OF COMPOUND NUMBERS

Problem: Add 2'7" and 8'10"

Step 1. Add the inch column.
7" + 10" = 17"

Step 2. Reduce the inches to feet and inches
17" = 1'5"
Write the 5" in the sum and carry the remaining 1' to the foot column

$$\begin{array}{r} 2'7" \\ +8'10" \\ \hline 17" \end{array}$$

$$(1')$$

$$\begin{array}{r} 2'7" \\ +8'10" \\ \hline 11'5" \end{array}$$

SUBTRACTION OF COMPOUND NUMBERS

Problem: Subtract 3'4" from 9'2"

Step 1. Since 4" cannot be subtracted from 2", borrow 12" from the 9' and add to the 2", thus changing 9'2" to 8'14"

Step 2. Subtract both columns
14" - 4" = 10"
8' - 3' = 5'

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 9'2"
-3'4"

 8'14"
-3'4"
 5'10"
```

MULTIPLICATION OF COMPOUND NUMBERS BY WHOLE NUMBERS

Problem: Multiply 3'7" by 8

Step 1. Multiply the inches by 8.
7' x 8 = 56"

Step 2. Reduce the product to feet.
56" = 4'8"

Step 3. Multiply the number of feet in the multiplicand by 8

Step 4. Add the results of Steps 2 and 3.
4'8" + 24'8" =

```
 3'7"
 x 8
24'+4'8" = 28'8"
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DIVISION OF COMPOUND NUMBERS BY WHOLE NUMBERS

Problem: Divide 31'3" by 15.

Step 1. Reduce the feet to inches. 31' = 372"

Step 2. Add the total number of inches. 3" + 372" = 375"

Step 3. Divide the sum by 15. 375" ÷ 15 = 25'

Step 4. Reduce the tuotient to feet. 25" = 2'1"

ADDITION AND SUBTRACTION OF COMPOUND MIXED NUMBERS

If the lowest-denomination units in an addition or subtraction problem involving compound numbers are expressed in fractions, we must first reduce the fractions to the lowest common denominator before proceeding with the calculation. The following addition problem illustrates this point.

Problem: Add 12'8-1/2", 17'4-3/8", 5'5-1/4", and 2'10-5/8".

Step 1. Reduce the fractions to terms of the lowest common denominator

Step 2. Add the fraction column and reduce the sum to inches. 4/8" + 3/8" + 2/8" + 5/8" = 14/8" 14/8" = 1-6/8" = 1-3/4". Write the fraction 3/4" in the sum and carry the 1" to the inch column.

```
LCD = 8
1/2 = 4/8
1/4 = 2/8
  (1")
12' 8-4/8"
17' 4-3/8"
 5' 5-2/8"
 2' 10-5/8"
```

Step 3. Add the inch column and reduce the sum to feet and inches. 1" + 8" + 4" + 5" + 10" = 28". Write the 4" in the sum and carry the 2' to the foot column.

Step 4. Add the foot column. 2' + 12' + 17' + 5' + 2' = 38'

(2')(1")
12' 8-4/8"
17' 4 -3/8"
5' 5-2/8"
2' 10-5/8"

MULTIPLICATION OF COMPOUND NUMBERS BY COMPOUND NUMBERS

To find an area for which both the length and width are expresses in compound numbers, one can multiply the compound numbers, but this can be time consuming, especially if fractions are involved. It is often sufficiently accurate to reduce the compound numbers to the nearest mixed denominate numbers to simplify multiplying them. For example, to multiply 2'6" by 8' 3-3/4" to find the area of a panel, change the 7" to 1/2' and 3-3/4" to 1/3'; then multiply 2-1/2' by 8-1/3'. In fact, for estimating purposes it would probably be sufficiently accurate to multiply 2-1/2' by 8-1/2'. If a more accurate answer is essential, reduce both compound numbers to feet and twelfths of a foot, then multiply the resulting denominate numbers; or reduce both compound numbers to inches, then multiply. The result will be square feet or square inches, depending upon the method used. (Remember that a square foot contains 144 square inches.)

DIVISION OF COMPOUND NUMBERS BY COMPOUND NUMBERS

Occasionally the need arises to divide one compound number by another compound number, for example to find out how many times one shorter length is included in another longer length, as in the problem that follows:

Problem: Divide 12'8" by 3'2".

Step 1. Reduce the feet to inches in each compound number. 12' = 144"; 3' = 36".

Step 2. Add the inches in each reduced compound number. 144" + 8" = 152"; 36" + 2" = 38".

Step 3. Divide the resulting denominate number. 152" ÷ 38" = 4. 4 x 3'2" = 12'8".

Note: Any remainder in such a problem will be in inches. For example, if the divisor in the above problem were 3'6" instead of 3'2", the answer would be 3 plus a remainder of 26".

Self Assessment

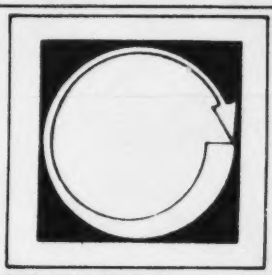
Write the answer to each problem in the corresponding space at the right.

1. Change 372" to feet. _____
2. Change 16'8" to inches. _____
3. Add 4'8", 17'3", 11'5", 44'2", and 32'10". _____
4. Subtract 23'8" from 57'2". _____
5. Subtract 28'11" from 32'10". _____
6. Multiply 3'8" by 9. _____
7. Multiply 22'4" by 37'11". _____
8. Divide 11'6" by 3. _____
9. Divide 19'2" by 3'10". _____
10. Add 7 hr. 18 min. and 3 hr. 47 min. _____

Self Assessment Answers

1. 31'
2. 200"
3. 110'4"
4. 33'6"
5. 3'11"
6. 33'
7. approximately 5.9 sq. ft.
8. 3'10"
9. approximately 4'9"
10. 11 hrs. 5 min.

Post Assessment



Listed below each problem are four possible answers. Decide which of the four is correct, or most nearly correct; then write the letter of that answer in the space to the left of the problem.

1. ____ 9'6" + 3'6" =

   a. 13'0"
   b. 13'6"
   c. 14'0"
   d. 14'6"

2. ____ 6'3" + 6'8" + 5'1" =

   a. 17'0"
   b. 17'6"
   c. 17'9"
   d. 18'0"

3. ____ If the height of a ceiling above the floor is 9'6" and the distance from the floor to the top of the window casing is 6'11", what is the distance from the top of the casing to the ceiling?

   a. 2'6"
   b. 2'7"
   c. 2'9"
   d. 2'11"

4. ____ Three identical metal frames are needed to complete a glazing job. The following pieces of metal extrusion are required to make these frames: 8 pieces 10'7" long; 9 pieces 8'4" long; and 3 pieces 3'9" long. How many inches of the metal will be required for each frame?

   a. 572
   b. 614
   c. 681
   d. 724

5. ____ How many 16" lengths of hanger wire can be cut from a roll containing 97'4" of the wire?

   a. 73
   b. 75
   c. 77
   d. 80

6. ____ Four boards, each 12'9" in length, are laid end to end. What is their total length?

   a. 42'6"
   b. 45'0"
   c. 49'3"
   d. 51'0"

7. ____ The following pieces of material are cut from a stock of 10 pieces, each 21' long: 2 pieces 4' long; 3 pieces 6 1/3' long; and 4 pieces 54" long. How many feet of the material remain in stock?

a. 164
b. 165
c. 166
d. 167

8. ____ Metal trim for a job was purchased from two different suppliers. Company A supplied the following: 4 pieces 5'11" long; 9 pieces 12'2" long; and 18 pieces 6'9" long. Company B supplied the following: 19 pieces 1'3" long; 18 pieces 9'4" long; 2 pieces 1'10" long; 10 pieces 5'5" long; and 4 pieces 1'3" long. How much more trim was supplied by Company A than by Company B?

a. 1"
b. 2"
c. 10"
d. 20"

9. ____ A glass shop receives an order to replace the tops on 6 showcases. Each of these showcases requires a new piece of green felt 2" wide and 6'3" long under the rear edge of the glass. How many square inches of green felt will be needed to do the entire job?

a. 850
b. 900
c. 950
d. 1,000

10. ____ What is the total length in feet and inches of the following pieces of flashing: 2 pieces 18" long; 10 pieces 78" long; 1 piece 29" long; and 6 pieces 10" long?

a. 69'9"
b. 75'5"
c. 84'7"
d. 88'3"

11. ____ In making a batch of mortar, a workman used lime an an amount equal to 12 percent of the cement. How many pounds of lime are necessary if 995 lbs. of cement are used?

a. 119.4
b. 121.8
c. 123.5
d. 130.2